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ERRATA.—In our last number, page 78, thirtieth line from top, for "one pound more," read, one pound *less*.

In No. 2 of FULTON, p. 68, 4th line from bottom, for "locks," read *canal*.
p. 69, 3d line from top, insert a period after the word canal.

The recent melancholy disaster, the burning of the Steamboat Lexington, has already been announced to our readers in all its distressing detail, through the columns of the daily press. As usual, public feeling has been much excited, and our papers have teemed with communications of every sort from the most bitter and injudicious invective against the captain and owners of the ill-fated vessel, down to the most elaborate apologies in their behalf. Although, in all this, there is undoubtedly much nonsense, yet good may eventually come from it, if the conductors of our daily press are careful to exclude such communications as bear marks of extreme ignorance or violent feeling.

It may be thought by some that there can be no use in discussing the matter at this late date, but we are of opinion that it is pre-eminently the duty of a Journal devoted to Internal Improvement to suffer no such accident to pass without a careful and candid notice.

On all occasions of this kind we find the majority of persons in the two extremes. One party rails against monopolies and chartered rights, etc., finding fault sometimes, where praise really is due, while the other blindly maintains the absolute infallibility of the company and all its employees. In this vast discrepancy of feeling, it is hard to get at the real merits of the case—in the present instance, however, the proper view of the matter seems to be generally taken, and there is, therefore, less difficulty in arriving at the truth.

In making our remarks, we shall freely and unhesitatingly express our opinion, in hope that others may be led to investigate the matter. In the first place we are to consider whether the owners are culpable in employing an unfit vessel or one not under proper management. In the evidence before the Coroner's Jury much stress seems to have been laid upon the fact that the vessel was sea-worthy. This doubtless would have been an important question, if the Lexington had gone to pieces, but has little or

no bearing upon the present accident. It seems that the vessel was one of ordinary strength with her boilers below. This is said to be much more dangerous than boilers on the guards, and the English steamers, in which the boilers are always below, are adduced as an example, accidents by fire it is said being in them by far the most numerous. We are not aware that this is a fact, on the contrary, we think that in English steamers there are fewer disasters occasioned by fire than by any other cause.* The specimens of this mode of building which we have had in the *Sirius*, *British Queen*, *Great Western*, &c., have convinced us that there is not a steam vessel in our waters so well guarded against fire. In fact there is no combustible in the vicinity of the boilers or engine with is not covered by metal.

So far it seems that instead of resembling the English steamers, the *Lexington* was unlike them in every thing save the position of the boilers.—That she was well guarded against fire could not be the fact, since it is stated on the best authority that fires frequently occurred, and sometimes threatened the destruction of the boat. This is attempted to be glossed over by the testimony of some one that it is *a common thing for steamboats to take fire*. If this is so, it is an alarming fact that hundreds of persons are daily endangering their lives without the slightest consciousness of their peril. It may be that the company owning this boat was not aware of her unsafeness in this particular, but we fear that it will require more white washing than they can accomplish to free themselves from all blame. From the manner in which the boat came into their possession, it cannot be supposed that they could have had much regard to her safety, even as far as concerned their own interests, and from the occurrences of the past year, it does not seem that they have valued public convenience so much as their own aggrandisement and the *extinction of all opposition*. We are to remember that during the last year an accident of unusual character occurred on one of their boats—at which time it was stated, and without contradiction, that the same difficulty had occurred before, though not with such a dangerous termination.

Again, is there any thing in the management of the boat or disposition of the freight so faulty as to throw blame upon the owners or their agents. It is said that cotton is too dangerous to be carried in steam-boats. This is certainly a very sweeping assertion, and one calculated to impose unnecessary restrictions upon steam-boat traffic. But was this cotton stowed in such a manner as to become a hazardous freight? This is quite another matter, and we fear will prove culpability on the part of the agents or persons employed in this part of the business. It does seem that a large quantity of cotton was stowed where, from the frequent fires on board, there was a great risk of setting fire to it and the vessel. If, as asserted,

* Since the above was in type, we find that the number of disasters in British steamers in 10 years is 92. Of these, 40 were such as might happen to all vessels at sea, 23 from explosion, 12 from collision and 17 from fire—the majority of the latter being caused by carelessness.

fires are common in steam-boats, such matters as cotton should certainly be placed as far from their place of occurrence as possible.

It is plain that the owners furnished the vessel in the proper manner with boats, (one of them a life boat too,) that they provided, as far as they could judge, an excellent captain, a sufficient crew and a fire engine, as well as iron rods for steering, as directed by law—but that they employed a vessel, known to be dangerous as to fire, not properly guarded in this respect, and that a large quantity of cotton was stowed in a dangerous place. They of course cannot be charged with wantonly sacrificing the lives of many persons—but they cannot wipe off the stigma of having by this culpable carelessness, encountered risks which finally ended in an awful disaster as serious to them, as far as pecuniary loss is concerned, as to any one else.

The next matter of inquiry, is one of more delicate nature, since it concerns one of the sufferers, we mean the captain. His conduct has always been gentlemanly, and as far as respect goes, that of an able commander. From the record of the awful occurrence, as given by the few survivors, it is thought by some that probably from constitutional inability, the energies of the captain were not equal to the dreadful emergency, while others are of opinion that he did all that could be done under the existing circumstances.

But whatever blame attaches to others, as having caused the accident, its fatal termination was brought about by the absolute madness of the *passengers*. The most horrible disorder must have attended the tumultuous efforts to escape in the boats. No one doubts, that on board a man-of-war every thing would have taken a different course, and that all would have been saved. But in the unorganized crowd of passengers, no one is found to command and no one to obey.

From the astonishing coolness and presence of mind, together with uncommon powers of endurance, manifested by Capt. Hilliard, it is presumed that the knowledge of his presence would have inspired confidence, and a right direction might have been given to the united labors of the passengers. A bold and unflinching demeanor, assumed by the proper person, might have restrained the unnatural disorder that prevailed. It is said by some that this fearful abandonment of reason in the extreme of danger is human nature. It is not—the assertion is a foul libel upon the human race, and a doubt of the goodness of our Maker. Who has not seen the timid, the sickly, even of the gentler sex, roused in the extreme of danger to uncommon exertion of mind and body. The very case before us furnishes four instances of human exertion and endurance of almost miraculous extent. In the case of the *Pulaski*, out of a smaller number of passengers, at a far greater distance from land, *fifty-four* were saved, and among them women and children. It is true that the present case was so far worse that it was in the winter season, and that many perhaps perished merely from cold.

To what then are we to attribute the extraordinary fright which in this

case, as in previous ones, has produced such fatal consequences? We conceive it to be almost a national peculiarity to manifest an utter recklessness and want of providence against danger and as utter a want of self control, and presence of mind in the crisis. The intense selfishness which is a prevailing trait at the present day—not only here but else where—prompts each one to take care of himself, to the exclusion of all others. It is morally and physically impossible for more than one hundred persons, situated as the passengers of the Lexington were, to attempt to provide each the means of individual safety, without endangering that of all.

It is not recollected that passengers as well as owners and captains, have responsibilities which are as binding and necessary to safety as those more frequently considered and commented upon. There is too much dependance upon the ordinary imperfect provision against accident, and no trust in a over ruling Providence, and when danger comes, and the reed we lean upon is broken, having no thought of a higher power, despair soon drives reason from her throne. We must say that in time of danger, we have often heard of conduct befitting a savage rather than a christian people. In an unbounded reliance upon our mechanical perfection, we seldom reflect, that moral causes have much bearing.

One word more before we leave this melancholy subject. There are peculiarities in the construction of English marine engine well worth our imitation. The whole machinery is firmly bolted and fastened into one mass of iron, without any dependance upon wooden support, except on the very bottom of the vessel. The most serious accidents may happen to the boat without deranging the machinery, or impairing its perfect action. A fire might destroy the whole upper works without stopping the engine. Although in the case under consideration, the better course might have been to stop the boat, there is no reason why we should not have machinery that could be trusted in such an emergency.

The use of a small deck fire engine, has sometimes proved of the greatest service when from the smoke and flame the large one below had become useless. At a trifling expense this additional means of safety could always be procured.

Having expressed our opinions as freely as we have considered our duty to require, we leave the subject with the hope that we shall never again be called upon to notice a similar disaster.

TABLE OF CUBICAL QUANTITIES, FOR DETERMINING THE AMOUNT OF EXCAVATION AND EMBANKMENT, IN THE CONSTRUCTION OF RAILROADS AND CANALS, WITH ILLUSTRATIONS.

TABLE OF QUANTITIES, FOR TRACING RAILROAD CURVES, WITH ILLUSTRATIONS.—BY EDWIN F. JOHNSON, CIVIL ENGINEER.

The first of the above tables differs from any of the numerous tables for a similar purpose, which have fallen under our observation. The ordinary tables give the cubic contents from the centre cutting, supposing the

ground to be *level* transversely of the line; or, from the outside stakes, supposing the ground to be *even* between these two points. It is obvious that these tables must be calculated anew for every different slope and breadth of roadway, besides which they are only sufficiently accurate in very even ground. It is said by Lieut. Lecount, (p. 33,) "The average height, however, can, in almost every case, be taken perfectly near enough for every practical purpose." Such is not the general opinion or practice in this country, and except in very even ground, at least two cross levels are taken on each side of the centre stake. Two are, however, in the great majority of cases, quite sufficient to ensure all desirable accuracy, and Mr. Johnson's tables are peculiarly applicable to this mode of calculation, though by no means limited to it, being also adapted to the measurement of masonry in piers, culverts, walls, etc.

The linear measures are supposed to be taken in feet, and the solid contents are given in the table in cubic yards, all calculated for a length, or distance, of 10 feet, so that it is only necessary to remove the decimal point one place to the right to obtain the contents, per chain of 100 feet, or, to multiply by a single digit, for lengths of 30, 40, 50, etc., feet.

The table embraces 4 different slopes, $\frac{1}{2}$, 1, $1\frac{1}{2}$, and 2 horizontal to 1 vertical, and gives the solid contents of pyramids, frustrums of pyramids and triangular prisims, for these slopes, besides a column for rectangular prisims into which all trapezoidal areas may be reduced. The latter column is calculated for a breadth of 10 feet, and, as the contents are directly as the breadth, it is easily applied to any breadth whatever.—This is evidently not the case with the pyramids and triangular prisims, which vary with the slope as well as with the depth. These latter values being given and the length remaining constant, (10 ft.,) the cubic contents are at once obtained by multiplying the areas by one-third the length for the pyramids and by the whole length for the prisims. These solids require, therefore, only one column for each of the 4 slopes.

The contents of the frustrums, however, are not so easily obtained, depending on the ratio of their basis. They form, moreover, the majority of cases in practice, and occupy two-thirds of the table, being calculated, not only for different slopes, but for different ratios of basis. The illustrations are particularly full on this point, and we shall conclude by the following quotation from the "Introductory Remarks," which says more for the usefulness of the table than any opinion of ours:

"As an evidence of the utility of the table, it may be stated that a few manuscript copies were taken in its original form, which, although less general in its application than the one here presented, have been for some time in use on several public works, and have been found to answer well the purpose designed."

The table for curves gives the offsets from the tangent to the curve for every 25 ft. from the point of tangency to the distance of 200 feet, and, as

the same offsets apply equally well to the continuation of the tangent on the other side of the point of tangency, the table is calculated for stations of 400 feet and for radii of from 379 feet to 137,500 feet. The offsets are those parts of the secants between the tangent and the circumference, or the secant less the radius, and are measured towards the centre of the circle. It is therefore necessary to know their inclination to the tangent, and the columns of angles and offsets are placed in juxta position in the table.

These tables are adapted to approximate locations, final locations, to laying the rails on the main line or in turnouts.

It is stated by Mr. Simms in the *Civil Engineers' and Architects Journal* for July, 1839, that he hopes shortly to publish a table of ordinates for setting out railway curves from tangents, which he has himself used for some years in England, and a table less complete than the one now offered to the public by Mr. Johnson, has been used on different public works in this State.

The usual mode has been to run out as many chords, of one chain each as could be seen from the origin of the curve; then to remove the goniometer to the station last determined, and proceed as at the origin. By the method of ordinates to long tangents much time is saved, and the number of angles to be measured is reduced, on ordinary ground, to about one-fourth of the number required by the usual mode. The table gives also the lengths of arcs to tangents of 200, 150, and 100 feet for the different radii.

The latter table will enable the young engineer to lay out any curve required in practice, with all possible accuracy, and, by means of the former, he will readily ascertain whether the curves so run will satisfy the other conditions of excavation and embankment, and if some modification be required, the table of ordinants will aid him in determining on the different degree of curvature required to place the line on the best ground. We have here, within the compass of a few pages, all that an assistant, familiar with the instruments, requires to enable him to locate a line and determine the quantities of excavation and embankment, and, as there are no similar tables published in this country, we have no doubt that these manuals will soon come into very general use.

The following abstract of a report made by "the Committee of Science and the Arts" of the Franklin Institute, Philadelphia, has been furnished us for publication.

PRESERVATION OF TIMBER.

"HALL OF THE FRANKLIN INSTITUTE, }
Philadelphia, Dec. 12, 1839. }

"The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts, to whom was referred for examination Dr. Edward Earle's method of preserving timber, "Report."

[The "Report" being long, and a considerable portion of it, although a

necessary part of the whole, irrelevant to the main purpose; an abstract of it may suffice to show the proceedings of the Committee, and the conclusions to which their investigations, experiments, and reasonings have conducted them as to the nature and qualities of the means employed, and the probable advantages and value of the "process."

Composed of many of the most distinguished members of the Institute—such as President A. D. Bache, Messrs Boothe, Peale, Frazer, Merrick, and others—the above Committee may be considered as constituting, in matters of science, the highest tribunal in our country, and the sanction of its approbation must go far to establish the character of those inventions and improvements on which it is conferred.

Having adverted to the form of the process, the materials used, and the mode of applying them, together with the different kinds of decay to which timber is liable, and which they agree with others in attributing to the gaseous, alluminous, and glutinous substances inherent in it;—they give a short history of the attempts which have been made in different countries to prevent or cure this costly evil. They proceed then to detail their own experiments made to determine the relative effects produced on the putrefactive constituents of timber by the sulphates of iron and copper and by corrosive sublimate, which salts they find to act *similarly and equally*, and are considered by them as the materials most powerful in their preservative agency; and also their experiments to ascertain the introduction of the sulphates by the proposed "process," into the body of different kinds of wood. In the course of the experiments made for these several purposes, the Committee satisfy themselves of the following results, most affecting the subject, which we give in the language of the "report" itself.]

"1st. That if these salts—the sulphates of iron and copper—penetrate the wood thoroughly, according to the process adopted by Dr. Earle, we have an economical substitute for the mercurial compound—the corrosive sublimate."

"2d. That the solutions *are* carried through the pores of the wood is conclusively shown by the experiments (detailed) on pieces taken from the interior of large pieces of timber which had been boiled with the solutions. The pieces were further split in half and the experiments made on the inner surface."

"3d. That heated solutions of various salts, such as corrosive sublimate and the sulphates of iron and copper, operate by expelling the gaseous matter and rendering the albumen and gelatine inert in all the parts of the wood which they penetrate."

"4th. That they—the sulphates—penetrate different woods in different degrees, *ash* being more thoroughly impregnated; *hemlock* nearly the same; *hickory* less so; and *oak* still less."

"5th. That the sulphates of iron and copper produce the precipitation of albumen equally well with the perchloride of mercury—corrosive sublimate—and that of gluten in a nearly equal degree; and that they are there-

fore to be considered as an excellent and economical substitute for that compound."

"6th. That therefore the penetration of wood by these salts—the sulphates of iron and copper—renders it less subject to decay and the attacks of insects."

"7th. That although theory and experiment thus go to show the diminished destructibility of the wood, experiments on a large scale should be instituted in order to ascertain the correctness of these views of the committee, without which they are of little value; but that the subject is one of sufficient importance, and the probability of success sufficiently strong to warrant the performance of such experiments with great care, and with less regard to the primary expense."

"8th. That lime penetrates wood in a similar manner"—[but the opinion of the committee as to the effect of lime on the wood being less favorable, their experiments and reasonings are not thought important to be communicated.

The process is conducted by means of boilers and wooden tanks, which, in size and cost, may be accommodated to any purpose—whether it be to prepare posts for fencing, or the largest ship timber; and is capable of reducing timber, in a few hours, from a perfectly green, to a perfectly seasoned state—a short time being allowed after the operation for drying. The efficiency of this method, it is believed, will prove at least equal to any that has ever been tried; while the facility with which it may be practised, and the trifling cost of it, give it powerful claims to general acceptance. The materials employed being inexhaustible, too, and not liable to fluctuation in price, can never occasion an augmentation in the cost.]

EDWARD EARLE, *Patentee.*

Philadelphia, January, 10, 1840.

Applications for the use of his patent &c., may be addressed to "Dr. Edward Earle, to the care of John C. Montgomery, Esq., President of the Little Schuylkill and Susquehanna Railroad Company," or "Wm. Rawle, Esq., Counsellor at Law, Philadelphia."

For the American Railroad Journal and Mechanics' Magazine.

INTERNAL IMPROVEMENTS OF NEW YORK. NO. 3.

In the two preceding numbers it was shown, and it is believed conclusively, that the enlargement of the Erie canal on the plan and to the dimensions proposed, is not now required, to accommodate the business upon it, and will not be for many years to come. Want of capacity, however, is not the only ground on which the enlargement of the canal has been advocated. It has been urged as indispensable to a reduction of the cost of transportation, and it is asserted that the saving, when the canal is enlarged to the dimensions as adopted, will be full 50 per cent., or one half the present prices. Should the inquiry be made from what data this inference is drawn, no better answer could probably be given than the very unsatisfactory one of its

being the *opinion* of gentlemen who were selected to examine and report upon the subject.

It will scarcely be credited that a measure of so much importance as that of the enlargement of the Erie canal, involving an expenditure of more than thirty millions of dollars, should have been undertaken without instituting the most rigid examination into the merits of the project, and particularly whether so vast an expenditure was essential to effect the leading object proposed to be attained, viz. a reduction in the cost of transportation so as to render the expense as nearly as possible a minimum. Such, however, appears to be the fact.

The great importance of determining in the very outset of such an investigation by suitable experiments, the dimensions of the canal and boats, adapted to the most economical use of motive power, is too obvious to need illustration, yet we are not aware that a single experiment was made by those whose duty it was to conduct such an inquiry, with a view to this object.

The information which it is natural to suppose would have been first sought for as essential to arriving at just conclusions on so important a subject was not obtained, except in a very vague manner and hence was not of a character to entitle it to any very great degree of confidence.

The only experiments to which any allusion is made in the reports are those of the Chevalier Du Buat. These experiments were made upon a very limited scale, "in a canal varying from $2\frac{3}{4}$ to $6\frac{1}{4}$ feet in width, and from $1\frac{1}{4}$ to $2\frac{1}{4}$ feet in depth. The boats used were prismatic in form, with *square ends*, the immersed part varying from 1 to $1\frac{3}{4}$ feet in depth, and from 1 to 2 feet in width." The velocity at which the boats moved was not given. It was from such data, principally, that conclusions were drawn in respect to the most suitable dimensions for the enlarged canal.

It will not be surprising if from such crude data, the authors of the several reports arrived at very different results. Two, at least, of their number, advocated an enlargement to the size of 80 feet width of surface by 8 feet depth, with locks 16 feet in width and 115 feet in length—while others were somewhat more rational in their views, but still erring and differing greatly in their conclusions.

In one report it was stated, that the burthen of a boat best adapted to a canal 60 feet wide and 6 feet deep, with locks 15 feet wide and 105 feet long, was 103 tons, in another it was put at 79 tons. In the estimated cost of transportation there was also considerable discrepancy.

We cannot avoid again expressing our surprise that these different opinions, based as they were in a great measure on mere conjecture, were considered sufficient for establishing the dimensions of one of the most stupendous works of the age—a work which was to cost millions, more especially as it was so easy a matter to have tested by proper experiments on the canals already in operation, the actual practical loss or gain of any change in dimensions which might have been proposed. Experiments of

this description were not made, nor were they recommended, although the expense would have been inconsiderable.

The dimensions established for the enlargement were those of 70 feet width of surface and 7 feet in depth. This result seems to have been reached, not by any systematic course of reasoning or logical deduction from well established data, but by the very singular process of taking the *average*, or *splitting the difference* of the several opinions advanced in the reports.

It is not unworthy of remark, as indicating the enlightened view taken of the subject in the reports alluded to, that in the several dimensions proposed, the ratio of the width of surface of the canal to its depth was assumed invariably the same, viz. as ten to one, corresponding with the present proportions of the Erie canal, which was undoubtedly taken as the standard. Upon this principle, a canal ten feet wide should be only *one* foot in depth, and a river one mile in width, to afford the most perfect navigation should be 528 feet in depth !

In the ratio proper to be adopted between the width of the locks and the canal, similar erroneous views were entertained and advanced in the report, and but for the representations of a third person, *incidentally* elicited, whose reasonings upon the subject could not be controverted, we should, in all probability, have witnessed the singular inconsistency of a canal 70 feet wide with locks only 16 feet in width ! or what would perhaps have caused still greater surprise, we should have witnessed the entire destruction of all the locks on the present canal, which are now 15 feet wide, and built of masonry, for the purpose of obtaining only *one foot* additional width !

Assuming that the ratios of the boat and canal which afford the least resistance as deduced from the experiments of Du Buat are correct upon the scale of the magnitude contemplated in the enlargement, it does not follow that an increase in the dimensions of the canal from its present size of 40 feet wide and 4 feet deep, to 70 feet wide and 7 feet deep, is essential to effect the desired saving in the cost of transportation. To render the resistance a minimum, or the same that it would be on an indefinite expanse of water, it is requisite according to the rule given by Du Buat, that the width of surface of the canal should be $4\frac{1}{2}$ times the width of the boat, and the transverse section of the canal 6.46 times that of the immersed part of the boat. These proportions, it should be distinctly borne in mind, are *independent of the absolute size of either the canal or the boat*, and hence are as applicable to *small* as to *large* canals. This fact has evidently been wholly overlooked by the advocates of the enlargement. One of the principal sources, therefore, to which we are to look for a reduction in the expense of transportation is not dependent upon the magnitude of the canal, but is quite as attainable on a small canal as a large one.

The width of the Erie canal is 40 feet, the locks 15 feet, and the boats about 14 feet. If the latter are proportioned to the width of the canal, ac-

According to the rule, they should be a little less than nine feet. The navigators on the Erie canal have not discovered it to be for their interest to make their boats of this width, but have invariably made them of the full width allowed by the locks, giving to the ratios above mentioned, a value not exceeding one half the amount prescribed by Du Buat. Du Buat's rule is therefore not applicable in practice, or there are other circumstances entering into the question of the expense of transportation, other than that of the resistance to motion or amount of motive power. A careful analysis of Du Buat's experiments shows that the resistance is not very sensibly increased if the ratio of the width is reduced from $4\frac{1}{2}$ to 4, and hence the gain by increasing to $4\frac{1}{2}$ is not commensurate with the expense of attaining that ratio, and the same may, we believe, be said with propriety of a ratio even less than 4. The only particular advantage resulting from a greater ratio, is that of being able to navigate boats with equal safety with a little less care and attention, and to diminish the resistance in passing.

For boats 14 feet wide, such as are now used on the Erie canal, a width of water surface of 4 times that amount, or 56 feet, is undoubtedly all that it is expedient to obtain. How very absurd, therefore, was it to propose, as was done in the reports we are discussing, a width of canal of 80 feet, for locks of 16, or boats of 15 feet in width!

Remarks, similar to the above, are applicable to the sectional ratio, which, it appears from the experiments, may be reduced from 6.46 to $5\frac{1}{2}$, without materially increasing the resistance. There is another reason, aside from the expense of obtaining it, why the maximum ratio in this case is not desirable. The down tonnage upon the canal, is from 4 to 5 times that conveyed in the opposite direction. Boats ascending, have consequently, on the average, much less draught than those descending—plainly indicating the inexpediency of adapting in practice, the canal and boats to the maximum ratio. But whether expedient or not, this is a consideration, as already stated, which relates more particularly to the *relative* and not to the *absolute* dimensions of the canal and boats. We are therefore to look for the benefits of the enlargement in its effect in cheapening transportation, *solely* to the advantages possessed by the use of boats *larger* than those now employed. The assertion has been frequently made, that the saving would be 50 per cent. or one half the present rates. The public have been deluded with the idea that the enlargement to the size proposed, was indispensable to, and would effect this reduction.

It is believed that nearly one-third of the expense of transportation is made up in the cost of animal power. Since, from what is shown above, this power can produce an useful effect as great, or nearly as great, on a small canal, properly proportioned, as upon a large one, it follows, that little or no saving can be anticipated from this source. *As to steam power, the advocates of the enlargement having scouted the idea of its profitable use on either a small or a large canal, we are relieved from making any remarks, in the present place, respecting it.* There may, and probably will

be, a saving in the cost of boats of larger dimensions, and also in their furniture and equipments, and in the number and wages of the crew, but this saving must of necessity fall far short of one half the whole cost of transportation, and, as we shall show, even this saving, which cannot reasonably be rated higher than 15 or 20 per cent., will be somewhat reduced by circumstances to which we have not as yet alluded, and not only so, but may in all probability be fully realised without resorting to an improvement to the *extent* of the proposed enlargement.

The question of the most economical size of boat for towing with animal power is one of great importance. Various opinions are advanced in the reports on this subject. The present boats, particularly those designed almost exclusively for freight, (and such, for reasons assigned in our last number, will, in all probability, be the character of the boats traversing the canal,) are towed with difficulty, when fully freighted, by two horses, at an average rate not exceeding two miles per hour, being probably the greatest speed at which power of that description can be advantageously employed. From information derived from those having experience in canal navigation, it is by no means certain that more than two, or at most, three horses, can be usefully employed in towing the same boat.

There is no evidence, therefore, that any important advantage is to accrue from the use of boats *very greatly* exceeding in capacity those now in use upon the canal—certainly none which can justify a belief in the statement, that the cost of transportation will be reduced 50 per cent., or render it proper to suppose that it will approach any where near that amount.

By an improvement in the locks, such as was suggested in the last number, that is, adding to their length, and wherever the pressure of business required, increasing their number, the capacity of the canal would be more than doubled. If to this improvement, be added that of widening and deepening the channel of the canal to the extent which may be easily and safely done, viz., by excavating from the berm side about 13 feet in width and using the material thus obtained for raising and enlarging the bank on the side of the towing path, an additional depth of water of from 1 to 1½ feet may be obtained, which will give to the boats a tonnage more than double that which they now possess, and enable the canal to accommodate more than quadruple the trade now conveyed upon it. Such an improvement, it is believed, will give to the boats a size about as well suited to economy in transportation as any other where animal power is used. It will give to the surface a width of 56 feet, being, as above explained, all that is expedient for a diminution in the resistance.

It will prevent the great destruction of property, resulting from the breaking up of the present mechanical structures on the canal, including locks, culverts, aqueducts, and bridges, etc., most of which are built in a very substantial manner. It will prevent the great injury to lands adjacent to the canal, resulting from an interference with the drainage consequent upon depressing the bottom of the canal to obtain the additional three feet in depth. It

may be accomplished without interfering with the navigation, or in any way deranging the business of the canal, in the short period of six years without resort to loans, using only for the purpose the surplus revenue of the canal; and last, though not least, it will save to the people of the State in the original outlay, full *twenty-five millions of dollars*, together with the interest to be piled on that amount of principal, and which it is justly to be feared, the nett revenue of the canal for a series of years, after the enlargement shall be completed, will not be able to liquidate.

This subject will be continued in the next number.

FULTON.

RAILROADS IN CITIES.—As the right of *city authorities*, or of legislative bodies, to permit railroad companies to lay *rail tracks* through public streets of cities and villages, is doubted by many, though we have never been of the number, nor do we doubt the sincerity of those who have doubts on this subject, we avail ourselves of the politeness of a friend, to lay before our readers the following decision of the *Court of Appeals of Kentucky*, at the spring term of 1839.

We give the letter, omitting the name of the gentleman who furnished us with the copy, and agree with him fully, as to the importance of the case, and therefore give place in the Journal, asking for it the attention of our readers.

For the American Railroad Journal and Mechanics' Magazine.

I have the pleasure to send you, herewith a manuscript copy of the report of the case of "the Lexington and Ohio railroad company, against Applegate and others," as given by the court of Appeals of the State of Kentucky.

In this case, the first legal talent of the State was employed on each side, and the great importance of the case, involving the vital principle of the *existence* of railroads; for if the defendants had prevailed, it would have been a fatal blow to the future progress of railroads in that State at least; and if adopted by other States, final in its effects throughout the country. Its importance, therefore, I should think such, as to justify you in publishing it in the Railroad Journal.

The cases reported in this volume, were selected by the Judges, under an act of assembly, which directs that they shall permit the publication (under State patronage,) of such cases only, as, in their opinion, "establish some new, or settle some doubtful point, or be otherwise by them deemed important to be reported."

The Court of Appeals of Kentucky, at the spring term, 1839, when the following cases were decided.

Judges on the bench—the Hon. George Robertson, Chief Justice of Kentucky. The Hon. Ephraim Ewing. The Hon. Thomas A. Marshall, Judges.

COURT OF APPEALS, KENTUCKY.

The Lexington and Ohio Railroad Company

vs.

Applegate and others.

[Mr. Guthrie and Mr. J. T. Morehead for the appellants. Mr. Crittenden and Mr. Pirtle for the appellees.]

From the Louisville Chancery Court. June 19, 1839.

Chief Justice Robertson delivered the opinion of the Court.

This appeal brings up for revision, a decree of the Chancellor of the city of Louisville, perpetually enjoining the Lexington and Ohio Railroad Company "from running, using, or employing their cars and carriages, by steam or otherwise, upon their railroad along Main street, between Thirteenth street and Sixth street," in the said city.

By an act of the Kentucky Legislature approved in 1830, "the Lexington and Ohio Railroad Company" was incorporated, with authority to construct a railroad from Lexington, to "some one or more points on the Ohio river;" and to use any land and materials, necessary for that purpose, by obtaining the consent of the owner, or by paying the value thereof, to be assessed upon a writ of *ad quod damnum*; and "to place on the road, when constructed, all machines, wagons, vehicles or carriages which they may deem necessary and proper for the purpose of transportation," and also to exact a prescribed toll for transportation of persons and property on the railroad. Having determined to make a point on the Ohio river, at or near the city of Louisville, the terminus, the company located its railroad from Lexington to Louisville, constructed it as far as Frankfort; and partially graded it between Louisville and Frankfort, and desiring to extend the road through Louisville, to the Ohio river, below "the falls," it obtained a supplemental act, in 1833, authorizing such extension.

Under the authority of these enactments the company, with the concurrence of the Mayor and council of Louisville, extended the location of its road, within that city to a designated point in Jefferson st.; and having afterwards obtained the consent of the Mayor and council to the construction of the road from Portland below "the falls" to Thirteenth street; thence along Main street, to Sixth cross st., and thence to the wharf; with permission "run its cars *by steam*, at the rate of not more than six miles an hour between Sixth and Thirteenth sts," it constructed the road accordingly, from Portland to the intersection of Main st., and Sixth cross st., in Louisville; and from the 29th of April 1838, until arrested by the Chancellor, on the 26th of October 1838, it had used the railroad between those points, chiefly by transporting daily about five hundred and fifty passengers in cars propelled generally by steam, though sometimes drawn by horses, at the price of twelve and a half cents for each passenger, instead of the accustomed hack charges, which have generally been from twenty-five cents to one dollar.

The injunction was granted on a bill filed by Elisha Applegate and forty-three others, most of whom were either owners or occupants of property on Main st., between Sixth and Thirteenth cross st., forty of whom were citizens of Louisville, and all of whom alledged that the railroad through the city, was a *nuisance purpresture* and unlawful encroachment on their private rights of property.

The railroad company, in its answer denied most of the principal allegations of the bill, and insisted that the road had not operated as a nuisance, or an encroachment on private right.

Between the granting of the injunction and the final decree, twenty-six depositions were taken and filed—ten for the complainants, and sixteen for the defendant. And, on the final hearing of the case on the bill, answer and depositions the Chancellor perpetuated the injunction as originally granted, upon the following grounds, stated in the conclusion of a very copious and learned opinion delivered when the first decretal order was made:—"It seems to me that the jurisdiction of the court to interfere by way of injunction, is clear according to established principles and precedents; that the case shows a common nuisance by which the plaintiffs have special damage; a purpresture amounting to a nuisance; a disturbance of easements annexed by grant to private estates and of privileges dedicated and secured by a public law of the general assembly of Virginia, in the streets and town of Louisville; of a corporation abusing the powers arising out of the act of incorporation, thereby working serious injuries to the complainants; and finally of a disregard of private rights, of a character continuous, vexatious, and degenerating into a species of irreparable nuisance."

In addition to those already suggested, the following facts clearly appear: first, that in 1781 Louisville with its main street and cross sts., from first to twelfth, as now and ever since existing, was established by an act of the Legislature of Virginia, vesting the legal title in trustees, and declaring that purchasers of lots should "have and enjoy all the rights, privileges and immunities which the freeholders and inhabitants of other towns in this State not incorporated by charter, have, hold and enjoy." Second, that the lots owned or occupied by the appellees on main street, between sixth and thirteenth cross streets, had been purchased from the trustees, many years ago, and have been held by the purchasers and their alienees ever since.

Third—that most of the wholesale and heavy business in Louisville, is, and ever has been, done on Main street, between Sixth and Second cross streets, that the population between Sixth and Thirteenth streets is comparatively thin, and that the business houses on that portion of Main street, are chiefly retail shops, groceries and coffee houses. Fourth—that the title and authority of the trustees of the town passed by the act of incorporation to the Mayor and Council of the city of Louisville, subject to all then subsisting trusts, private rights and public obligations; and fifth—that Main street is ninety feet wide; the railroad in the centre, with a single track; and the entire street, since the construction of this track, has been used as a pass way for all persons and vehicles, without objection by the railroad company, and without any assertion by it of an exclusive right to use that portion of the centre of it which is covered by, and included within, its *flat* iron rails.

But, as to the effect of the railroad, and of the use made of it by the company, there is much diversity in the opinions of the witnesses, who testified in behalf of the appellees, and of those who deposed on the side of the appellant.

Some of the ten witnesses for the appellees expressed the opinion, that the rails of the railroad obstructed the free and convenient public use of Main street; some of them testified to facts conducing to show that the use made of the road by the company, and especially by the frequent transportation of passengers in a long train of cars, propelled by steam, alarmed horses, and endangered the security of persons passing on foot, on horses, and in hacks and private carriages; and all of them averred, that in their opinions the railroad, as constructed and used, had the effect of diminishing the value of real estate on Main street, between Sixth and Thirteenth, and of injuring the commercial and manufacturing business of those who resided there; and that, therefore, it was a public nuisance, and an injurious encroachment on the private rights of the appellees and of many others.

On the other side—most of the sixteen witnesses for the appellant, (and all of them who testified as to this point,) expressed the opinion, that the railroad itself was no obstruction whatever to the safe, free and convenient public use of the entire street by all who might choose to use any portion of it; and they stated facts strongly conducing to that conclusion. All of them expressed the opinion, that the prosperity of Louisville, and the public interest had been promoted by the use that had been made of the railroad from Portland to Sixth cross street in the city, and would be still more advanced by the completion and use of the continuous line of railroad communication, according to the charter and the avowed purposes of the company.

No one of them considered the use as made of the road even with steam power as being a nuisance, or as injuriously affecting the value of property the productiveness of business, or security of persons on Main street, between Sixth and Thirteenth, or elsewhere. Most of them were of the opinion, that as steam when well regulated as a motive agent, may be more easily and promptly controlled than horse power cars propelled by steam with a velocity not exceeding six miles an hour, were more safe to the public than cars drawn by horses, and were not more perilous or inconvenient than hacks, stages and omnibusses.

Some of them proved that cars are run by steam through some of the towns and cities in Europe, and through Orleans, Lancaster, Philadelphia, Richmond, Frederick, and several other town and cities in the United States, without having been considered nuisances, so far as they had heard or believed; and that some of the streets, through which long trains of cars moved by steam, are frequently running, are narrower, more populous and much more thronged than Main street in Louisville, between Sixth and Thirteenth cross streets. Some of these witnesses, also, indicate by their testimony, more than an ordinary acquaintance with railroads and steam power—and all of them state facts conducing persuasively to sustain all the opinions they have expressed.

It neither appears, nor has been suggested, that the speed of the cars, when propelled by steam on Main street, in Louisville, had ever exceeded the prescribed rate of six miles an hour; and it does appear clearly that the travelling and commercial public would be benefitted by the continued use of the railroad, as constructed and hitherto used, from Portland to the heart of Louisville; and the more especially, during that season of the year when the boats cannot pass over the falls of the Ohio river.

Upon these facts, the Chancellor's decree is to be revised, and either affirmed or reversed. The streets of Louisville were designated, not only for subserving the public purposes for which the town was established by law; but also, for the especial convenience and enjoyment of such persons as should purchase and hold lots contiguous to them. The title to such lots carries with it, as essential incidents, certain services and easements, not only valuable and almost indispensable, but as inviolable as the property in the lots themselves. And, therefore, the owners and occupants of houses and lots on Main street, between Sixth and Thirteenth, have a peculiar interest in that street, which neither the local nor general public can pretend to claim—a private right of the nature of an incorporeal hereditament, legally attached to their contiguous ground—and incidental title to certain facilities and franchises assured to them by contract and by law, without which their property would be comparatively of but little value, and would never have been bought by them.

Although, therefore, an ordinary public way may be discontinued or applied to some other public purpose than that for which it was first establish-

ed, without any legal liability for pecuniary compensation to the local public, or to any owner of adjoining land—because neither such public or proprietor had any right of property in the way or any other legal interest in it than that which was common to all the people, and though, also, the Mayor and Council holding the legal title to the streets of Louisville, in trust chiefly for public purposes, might regrade and improve those streets, or authorize the public use of them, in any mode consistent with the objects to which they were first dedicated, without obtaining the consent of the owners of the lots thereon, and without making any compensation to them—nevertheless, there may be no constitutional authority for closing or discontinuing any one of the streets, or even for applying it to any public or private use, incompatible with any one of the ends for which such street was established, without first obtaining the consent of the owners of lots thereon, or without making just compensation to them for any damage which may result to their property, corporeal and incorporeal, from such exclusion, discontinuance or new application of the street.

The commonwealth, with all her sovereign right of eminent domain cannot take away private property, even for the most imperious or important public use, without either the owner's consent, or the payment to him of a just equivalent in money.

But, we cannot concur with the Chancellor in the opinion, that the commonwealth could not constitutionally exert her eminent authority, to take private property for public use, through the instrumentality of the railroad company. Public roads of all sorts, may be constructed wherever the sovereign shall be pleased to have them; and if the public choose to avail itself of the capital and liberal spirit of select persons for insuring the construction of an important highway, the persons who may agree thus to appropriate their own funds, may surely be permitted to enjoy, as some equivalent for the expenditure, the profits of tolls prescribed by law, for using the road, and may be authorized to construct and preserve it by all the means which the commonwealth could constitutionally employ. The sovereign will can be effectuated only by the instrumentality of agents. And in the case just supposed, the private association should be deemed the agent of the public, although as to its conventional privileges and profits, it may be only a private corporation; and the road also should be considered, in the popular sense, a public highway.

In 4 East, (2nd ed.) p. 21, it was adjudged, that though the lord of the fee was entitled to the profit arising from the use of an established road, yet it was a public highway—"le haut chemin le Roy." When the legislature incorporates an association of private persons for the purpose of making a turnpike road or a railroad, the public welfare should be presumed to be the legislative object of the enactment; and though the interest of the corporators be private and exclusive, yet the construction of the road should be deemed to have been authorized for the public good, as the chief and primary object; and the act of incorporation, and the privileges granted to the corporators should be considered only as a means for effecting the public end, and as secondary and incidental only.

And to accomplish such an end by such means; the sovereign power may, undoubtedly, as we think, exert through such an instrumentality, all the constitutionally authority which it might employ, for the effectuation of a similar object by any other agency, or in any other mode. The railroad is applied to "public use," though the profits are appropriated to private use.

And the legislative authority to take private property implied, that when so taken it would be appropriated to the use of the public. The right of

eminent domain has long been exercised in similar modes here and elsewhere, without question, and in instances almost innumerable. In this manner nearly all the turnpike roads have been made, and all the railroads; and thus, too, are mills established; by the condemnation of private property on the application of persons who desire to make profits by the tolls:—and the cities of Lexington and Louisville, and other incorporated cities, thus only exercise the power of opening new streets, by taking private property, upon the payment of the assessed value of it, to the owner or owners.

This proposition was considered so indisputable, that this court, in the case of *O'Hara vs. the Lexington and Ohio railroad company*, (1 Dana, 232,) decided that an appeal by *O'Hara*, from a judgment on an assessment of damages upon a writ of *ad quod damnum*, should be affirmed without argument as a delay case—the only ground for prosecuting the appeal being the assumption that the legislature had no constitutional power to authorize the company to take his land without his consent, even upon paying the assessed value of it. Judge Underwood did not, as the Chancellor seemed to have imagined, dissent from the opinion that there was no plausible ground for seeking a reversal of the judgment. In that opinion he fully concurred; but, as the report of the case itself will show, he thought the submission was premature, only because the appellant had not filed the record, and the case was submitted by the appellee, upon a record filed, without the appellant's concurrence, only a few days after the appeal had been taken.

In such a case, the court did not consider it necessary to write an elaborate opinion, but was contented with a suggestion of the general reasons which it deemed satisfactory—believing, as it did, that, upon such a point as that then involved, such a brief and comprehensive opinion was better than much amplification.

The brevity of the opinion ought not, therefore, to have been assumed, as it has been by the Chancellor, as proof that the judgment of the court was hasty and inconsiderate. A similar judgment has been virtually rendered in many other cases in this court and in many other courts; and the Chancellor's decree exhibits the only opposing judicial opinion we have seen or heard of; "*Aliquando bonus dormitat Homerus.*"

But there was no writ of *ad quod damnum* in the city of Louisville.

Nor was such a proceeding necessary unless the railroad or the use of it should be deemed to have been a purpresture or a nuisance operating to the damage of private property or the injury of some private right.

The purchasers of property on Main street, as on every other street, took their respective lots of ground subject to all the contingencies that might arise to it and to the use of it, from all the uses which might ever be made of the street as a public way, consistently with the objects of its original dedication.

If the construction of the railroad and the use made of it were not inconsistent with those public objects, nor with private rights, the Mayor and council of the city of Louisville had an unquestionable right to authorize such construction and use of it, without any *ad quod damnum*. Unless the railroad on Main street be, *per se* or otherwise, a nuisance, either public or private, then, as all persons have an equal right to use the street, with carriages for transportation, consistently with the objects of its dedication, we cannot doubt that the railroad company, under the sanction of its charter and with the permission of the local municipality, had a right to lay its own iron rails in the streets, for the purpose of facilitating the use it might rightfully make of it, in cars adapted to the improved mode of transportation

on railways. And unless the railroad, either in itself, or in the use made of it, should be considered a purpresture or other nuisance injuriously affecting private rights, and which even the Legislature could not constitutionally authorize, there could have been no necessity for an *ad quod damnum* to assess damages which no person would have been entitle to claim.

The supreme law requires such an inquisition only, when private property is taken and applied to public use; and private property, could not be considered as being thus taken or applied when there is neither any injury to or deprivation of any private right. Any injury to private right by either the construction or the use of the railroad, would be a private nuisance.

And if the road, or the use made of it, did not thus operate, there was no necessity for an inquisition concerning damages. And therefore, in the language of Justice Holroyd, in *Rex vs. Russell et al* (13 Eng. Com. Law Rep. 254,) we are clearly of the opinion that, unless the railroad, or the use made of it, should be considered, "upon the facts and merits, a nuisance, the neglect to make them the subject of an *ad quod damnum*, will not make them so."

Nor, if their be no such nuisance, could there have been any breach of the compact with Virginia, or an impairment of the obligation of any contract implied in the purchase of lots by the appellees and other citizens of Louisville.

If either purpresture, or other nuisance, injurious to the private rights of the appellees be clearly established, the Chancellor may have had jurisdiction to enjoin such wrong.

But both public policy and a long series of adjudged cases, require that a public improvement, so beneficent in its general operations and results, and more especially when, as in this case, sanctioned by the Legislature of the local public, should not be destroyed or suspended by the injunction of a Chancellor unless strong reasons for doing it be conclusively manifested. The only decisive or pertinent question to be judicially considered in this case, is, therefore, whether a purpresture or other nuisance injurious to private rights, has been satisfactorily established by the appellees.

A purpresture being the appropriation to exclusive private use or the enclosure for such use, of that which belongs to the public—it seems to us, that the facts exhibited in this record, will not authorize the conclusion that the railroad itself, abstracted from the use made of it in the city of Louisville, was ever such a nuisance or wrong as is technically denominated purpresture.

The opinions and the facts presented in the record preponderate decidedly against any such deduction. And if, as should be presumed, in the absence of proof to the contrary, the road has been constructed as was required by the corporate authorities of Louisville, and as it certainly might have been constructed, it may not obstruct the public use of the whole street by any person who may wish to use any portion of it in any accustomed mode. And it is evident that the entire street, railroad and all, has been used by the public as a common highway for wagons, carriages, horses, and footmen, without objection by the railroad company, or even the assertion of a right in the company to any exclusive use of that part of it covered by and contained within its rails. It appear to us, therefore, that there has been neither an enclosure of any part of the street by the company for its exclusive private use, nor any appropriation of any portion of it to such exclusive use, in merely constructing the railway. If such exclusive use should ever be monopolized, or attempted, then it will be time enough to denounce the railroad as a purpresture. It is premature to utter such a denunciation

now, merely because the charter vainly purports to confer the empty and unavailing right to such use.

Nor for the same reasons, can the railroad, in itself alone, according to the evidence and all proper deductions and presumptions, be deemed a nuisance in any effectual and injurious sense.

This is virtually conceded by the Chancellor's final decree; for if he had considered the mere rails in the street as being a nuisance, he would as we presume have not left the nuisance remaining as he has done, by only enjoining the running of cars upon the rails; but would have also required the removal of them, and a restoration of the street from their noxious effects.

Did the use which was made of the railroad on Main street operate as a nuisance, injurious to private rights? This is the only remaining question we deem worthy of grave consideration. As already intimated, we cannot concur with the opinion expressed by the Chancellor, that the possibility that the company may at some future day, arrogate to itself the exclusive use of the railroad track along Main street, shows, or tends in any degree to show, that either the road itself or any use hitherto made of it, should be deemed a nuisance. Nor can we doubt that the fact, that the appellants may have lost something of interest merely, such as a reduction in the profits of their business, or in the value of rents of houses, is insufficient to show a nuisance, or authorize an injunction. There must have been an invasion or deprivation of some right, before they could be entitled to any relief in a court of equity.

We have admitted that neither the constituted authorities of Louisville nor the legislature of the State, could either license a private nuisance, or could take or encroach on private property, without the owner's consent, or the payment to him of adequate damages, or could appropriate any street in Louisville to any use to which it was not originally dedicated, unless the consent of all those immediately interested in such street should be given, or just compensation should be first made to them.

But, even though some persons owning property on the railroad street, may be subjected to some inconvenience, and even loss, by the construction and use of the road, yet if the use made of the road be consistent with the just right of all, such persons have no right either to damages, or to an injunction; because they purchased their property and must hold it, as all others purchase and must hold town lots, subject to any consequences that may result, whether advantageously or disadvantageously, from any public and authorized use of the streets, in any mode promotive of, and consistent with, the purposes of establishing them as common highways in town, and compatible with the reasonable enjoyment of them by all others entitled thereto.

As the Legislature and the local authorities of Louisville authorized the construction of the railroad through that city, and also authorized the company to employ upon it cars and steam power; and the more especially as such improvements in the means of transportation must be useful to the travelling and commercial public, and in many respects, obviously advantageous to the local public of the city itself; it does seem to us that, *prima facie*, the ordinary and careful use of the road, as thus authorized and prescribed, should not be deemed a nuisance, public or private.

This deduction is fortified by the fact already suggested, that railroad cars, drawn by horses, and propelled also by steam, are permitted to pass through other cities in both Europe and America, and have not in any instance been adjudged nuisances; and the facts proved in this case corroborate the same conclusion.

Main street in Louisville was established as a common highway for the universal public; and as said in *Rex vs. Russell*, "the right of the public is not confined to the purposes of passage; trade and commerce are the chief objects, and the right of passage is chiefly subservient to these ends."

It must be an extreme and anomalous case, in which an improved mode of transportation, which not only facilitates passage, but promotes trade and commerce in and through the city of Louisville, could be nevertheless a nuisance. It should never be so considered, unless in its operations it unreasonably circumscribes or excludes the rightful use or enjoyment of Main st., by others, who have an equal right to the use and enjoyment of it.

Russell and others, indicted in England for a common nuisance, by the erection of Staiths in the river Tyne, for facilitating the coal trade, were acquitted on the ground that, though the erection abridged the common use of the river as a navigable stream, yet it was for a public purpose, was in a reasonable situation, left a reasonable space for the passage of vessels, and was beneficial to England, by producing a reduction in the price and an improvement in the condition of coal.

And the Court of King's Bench, consisting of Lord Tenterden, Chief Justice, and Bailey and Holroyd, Justices, refused a new trial—the two latter concurring, and the former dissenting only on the ground that he was inclined to think that it was not, as the jury had been instructed, the fact of benefit to England, but the fact of an improvement in the business of the Tyne, which should be considered as decisive against the charge of nuisance.

In the case of the *King vs. Edward Pease and others*, (24 Eng. Com. Law, Rep. 17,) the Court of King's Bench rather approved the decision in *Rex vs. Russell* and others, and seemed to recognise the principle that an injury to one mode of transportation and travel, by the rival use of another mode more beneficial to the public, was not a public nuisance. Under the authority of an act of Parliament, a railroad with the stationary privilege of using steam power, had been constructed parallel with, and almost contiguous to, a previously established and then existing public turnpike, from Stockton to Yarm, in the county of Durham—and Pease and others were indicted for using on the railroad, ten locomotive engines propelled by steam, to the great alarm of horses, and the annoyance and peril of persons travelling on the turnpike; but, though the facts were proved, the accused were acquitted, and the Court of King's Bench approved the verdict chiefly on the ground just suggested.

But, in the subsequent case of the *King vs. Ward*, (31 Ib. 91,) the same Court in an opinion delivered by Chief Justice Denman, seemed to concur with Lord Tenterden, in the distinction intimated in his dissent in *Rex vs. Russell*, et al. And we should be inclined to concur in this last view, as the more reasonable and authoritative.

The cases which we have just noticed, chiefly involved the question of public nuisance; but they recognize a plain principle applicable to this case; and that is when applied to this case, just this—that, even if the use of the railway in Louisville may in some degree have occasionally operated as an enclosure of a small part of Main street, along the centre of it, or diminished or rendered less convenient or free, other uses of it, by persons equally entitled to use it in other modes, still, though a compensatory benefit to the general public, might not be sufficient to show that it was nevertheless, not therefore a nuisance, yet such a benefit to the business of the street as a highway for passage, transportation and commerce, resulting from such a use of the street, by the railroad company, as did not unreasonably disturb others in the rightful use of it, could not be considered wrongful. And this principle is evidently just and undeniable.

Unless, therefore, it clearly appears in this case, that, in the use made of the railroad by the running of cars upon it, other accustomed uses of it were excluded or unreasonably obstructed or abridged, or private rights invaded, the Chancellor's injunction cannot be maintained.

And this inquiry is devisable into two branches:—First, was the running of a car on the railroad a nuisance? Second, did the length of the train of cars which were used upon it, or the frequency of the transits, constitute a nuisance?

First. As it appears clearly, from the testimony, that a single car drawn by horses was not more inconvenient or perilous than a wagon, stage coach or a hack, we are bound to infer judicially that, so far as the use of the railroad may be concerned, the prudent running of one such car upon it cannot be deemed to have been a nuisance in any respect. Nor do we feel authorized, by the facts now before us, to decide judicially that the discreet running of any single car propelled by steam, was any nuisance.

We will not presume that the ordinary operations of a well regulated steam engine must necessarily be a nuisance in a city or town; and especially when, as in this case, we have facts and opinions of observant men, conducing strongly to the conclusion that a steam car in motion on the street of the city, is not, merely as such, a nuisance, public or private.

A steam mill or manufactory has never, so far as we know, been adjudged a nuisance, merely in consequence of the peculiar character of the moving agent; nor has a steamboat or ship, merely as such, been ever considered a nuisance any where. Railroads frequently cross other highways are sometimes parallel with them, and always pass, at some point, through a dense and travelling population.

And of course, wherever they may be, if steam engines be used upon them, persons travelling in stages, private carriages, on horse, or on foot, are often subjected to some annoyance, inconvenience and hazard. Steamboats, also, are necessarily prejudicial to other boats.

But a steam car on a railroad, or a steamboat on a river, is not, therefore, *per se* a public or private nuisance, they have both become eminently useful as means of commercial and social intercommunication; and their prevalence and success only demonstrate their great utility and general popularity.—They may curtail the profits of carts, drays, arks and wagons; but they do this only because they are preferred, and the interests of society require the use of them.

They may also do, as but too often they have done, private injury and personal damage. But such occasional consequences must be expected from other agents of transportation in a populous and prospering country.

Therefore, according to the testimony in this case, we cannot decide that either a horse car, or a steam car, running cautiously on Main street in Louisville at the rate of only six miles an hour, should be deemed to be a nuisance to the public, or to the appellees, or any of them.

We are, therefore, of the opinion, that the Chancellor ought not to have enjoined the use of the railway altogether by the running of any car upon it. Second. Nor do we feel authorized, by the facts as now presented to us in this record, to decide that either the train of cars, as used on the railway, or the frequency of their transits, operated as a nuisance in judgment of law. Though the train may have been generally from sixty to ninety feet long, and though also, it may have passed frequently every day, yet it has not been satisfactorily shown that, either the crossing of the street has been unreasonably obstructed, or that the open space on each side of the railway were not always sufficient for the passage of wagons, carriages, horsemen and foot passengers, without unreasonable inconvenience, unless the appre-

hension and surprise occasionally produced by the novelty of the spectacle, the noise of the cars, and the puffing of the steam pipes, should be deemed unreasonable.

But these alone we are not authorized so to consider, as we have already suggested. The proofs incline to the opposite conclusion. It would be unreasonable to use a longer train than the ordinary purposes of a safe and useful transportation should require. It would be unreasonable to make more transits than the same objects should demand.

It would be unreasonable to detain the cars on the street any longer than a faithful and vigilant superintendent should find necessary for effecting those objects, prudently and as safely and conveniently to the rights of others as possible. It might be unreasonable to run a long train of cars in quick succession, and at uncertain periods and irregular intervals, so as to take the public by surprise. And it might, perhaps, be also unreasonable to use a train as long as ninety feet, or to make successive transits so frequently on Main street, as was done when the cars were used upon it by the company. But the facts appearing in the record do not enable us to determine, certainly or satisfactorily, that, in any of these particulars, the company had habitually, or even in any instance, transcended reasonable limits.

Nor are we convinced, by the facts now appearing, that any public right of passage upon, or other use of Main street, or any franchise, or personal security, has been unreasonably abridged by the railway, or by the use which has been made of it. The evidence when carefully compared and weighed inclined to the opposite conclusion.

And, considering the sparseness of the population on Main street, between Sixth and Thirteenth, and the character of the business chiefly done in that portion of the city, it may not be unreasonable to infer, from preponderating opinions in the record, that the use hitherto made of the railroad by the company in the running of its train of cars, may not have been unreasonably prejudicial or inconvenient to the appellees, or to any portion of the public. If there has been, as alleged, some diminution in the profits of a few persons engaged in business, between Sixth and Thirteenth, the facts authorize the inference, that this has resulted chiefly, if not altogether, from the translation of that business, by the cars to other portions of the city, or from the conversion of it into some other and more useful business, in consequence of the facilities afforded by the railroad.

This is no ground of just complaint. It is but a common case in commercial cities; and will always occur in a greater or less degree, from all improvements in the arts, and all public improvements for facilitating travel and commerce.

And it is evident, that the use of the railway, as made by the company, produced to the city of Louisville and to the public generally, much more of good than of evil.

In such a case, we cannot decide that the use which had been made of the railway in the city, had been so excessive or injurious, or unreasonable, as to authorize this court to require any prescribed curtailment or modification of that mode and kind of use. No facts appear which would enable us to determine the precise manner and extent of limitation upon the use, even if, as may not be altogether improbable, there had ever been, in any respect, any use unreasonably or unjustly inconsistent with private rights. As a guarantee against abuse, the municipality reserved the power of revocation, if the running of the cars, or the construction of the railway itself, should ever become an obstruction to the free and common use of the street by the entire public, or should unreasonably endanger personal security.

The fact that the public authorities of Louisville have not interposed or complained, tends rather to repel the inference that the running of the cars has been unreasonable or injurious. And the deduction from this circumstance is, in some degree, corroborated by the fact, that only ten persons have deposed in favor of the appellees. As, therefore, it does not satisfactorily appear from the record that the railroad has been used in such a manner as to authorize restriction or modification by the order of this court; and, as the evidence would not enable us to prescribe any precise curtailment or modification of the use of it by steam power and cars—we do not feel authorized to perpetuate the Chancellor's injunction to any extent, or in any respect.

If, hereafter it shall ever be ascertained satisfactorily, that an injurious abuse of its privileges is committed by the company, those privileges may be revoked by the official guardians of the interest of the citizens of Louisville, or the company may be restrained within reasonable limits by the Chancellor upon ascertaining such facts as may enable him to prescribe proper and exact regulations for controlling the use of the road in the city. Were we to undertake such a task now, we should act without sufficient authority from the record before us, and should make a leap in the dark, whereby we might unjustly prejudice private rights and important public interests.

In such a case, involving such interests, no injunction should ever be decreed, without clear proof of a nuisance, injurious to the private rights of the applicants. If there has not been an unreasonable use of the railroad in Louisville, injurious to the rights of the appellees, we cannot sustain their injunction merely on the ground (if it had been even satisfactorily established) that they may be subjected to some inconvenience, and even loss, in consequence of the novelty of this mode of transportation in their city, or the extent of its success in a fair competition reasonably conducted.

If a train of cars, occasionally obstructed, in some slight degree, a perfectly free and convenient passage of a private carriage, or wagon, or horse, and produced some apprehension and even danger, successive hacks, or stages, or omnibusses, with the same number of passengers, might perhaps have caused the like obstruction, apprehension and damage. Such inconveniences, whenever they may have occurred, might have been, and we cannot say they were not, the ordinary consequence of the free and common use of a public street in a commercial and prosperous city. And when they occur without negligence or wantonness or unreasonable pretension, they should be considered by the citizens, as evidences of the appreciation, rather than the depreciation of their property. For that very business and bustle which must inevitably produce some such occasional inconveniences, and collisions, and personal losses, Louisville was established, and its main street made as it is. And as that growing city shall continue to grow and prosper, similar accidents will more frequently occur, and be more sensibly felt. And, if there shall never be another steam car or horse car upon its streets, hacks and omnibusses, perhaps as pestilential and not so suitable will crowd the way, and supply their places, possibly to the disadvantage of the city and the whole community; and when too, the houses on the street between Sixth and Thirteenth, will not as now, be "few and far between," nor be occupied as now, chiefly by retail shopkeepers and retailers of liquors.

The onward spirit of the age must, to a reasonable extent, have its way. The law is made for the times, and will be made or modified by them.

The expanded and still expanding genius of the common law should adapt it here, as elsewhere, to the improved and improving condition of our

country and countrymen. And therefore railroads and locomotive steam cars the offsprings, as they will also be the parent of progressive improvement, should not, in themselves, be considered nuisances, although in ages that are gone, they might have been so held, because they would have been comparatively useless, and therefore more mischievous.

We know that a zealous and inconsiderate spirit of innovation and improvement requires the vigilance and restraint of both reason and law. We are fully aware, also, of the fact that, when such a spirit is abroad, private rights are in peculiar danger, unless sternly guarded by the judiciary; and we are not sure that such guardianship is not most needed in a government where whatever is popular is apt to prevail at first, and often at last, only because it is the *vox populi*.

This case has been, therefore, carefully and anxiously considered, under a full sense of its magnitude, and of all the responsibilities of an authoritative decision of it by the court. After thus considering it, upon all the facts presented, we are unanimously of the opinion that no cause has been sufficiently established for enjoining the use of the railroad in Louisville, as the Chancellor did, altogether, or for enjoining even such use as has been made of it by the railroad company.

We do not wish to be understood as deciding, that we are satisfied that the use of the railway, as hitherto made in Louisville, was not in any respect a nuisance. All we have decided, or intended to decide, is that the facts upon which alone we have had to adjudicate in this case, do not authorize the judicial deduction that a nuisance has been sufficiently proved. If it shall ever hereafter satisfactorily appear, upon other proof, that such use as that complained of by the appellees, encroaches on any private right or obstructs the reasonable use and enjoyment of the street, by any person who has an equal right to the use of it, we shall be ready to enjoin all such wrongful appropriation of the highway. The railroad company having made its answer a cross bill, and prayed for damages sustained by it, in consequence of the injunction, the Chancellor, in his final decree, dismissed the cross bill absolutely; and the appellant complains, also, of that decree.

The Chancellor granted the injunction without requiring any bond or other security.

Whether this was proper or not, we need not now determine. But in this state of the case, if, as may be presumed in the absence of proof to the contrary, the appellees filed their bill, obtained the injunction, and prosecuted the suit in good faith, believing that the railway, or the use made of it by the company, was a nuisance operating to their private injury, it is our opinion that they are not, according to any adjudged case, or established principle of equity or law, responsible for damages.

As they have never undertaken to pay any damages in the event of an ultimate dissolution of their injunction, it seems to us, that they could now be made liable only for a malicious prosecution. And not only is there no satisfactory proof of any such vexatious or wanton motive, but we are inclined to think that if there had been, a court of equity was not the appropriate forum for assessing the damages, to which the appellant would in that event be entitled. Whether, therefore, the Chancellor had jurisdiction over the matter of the cross bill, or whether he had not, his decree dismissing the prayer in that bill for damages, was, in our opinion, proper. Wherefore, it is decreed by this court that the decree of the Chancellor dismissing the cross bill be affirmed; and that the decree perpetuating the injunction against the running of cars on the railway on Main street, between Sixth and Thirteenth cross streets, in the city of Louisville by the Lexington and Ohio railroad company, be, and the same is hereby reversed; and

that the cause be remanded, with instructions to dissolve the said injunction, and dismiss the original bill, with costs.

We have before this had occasion to commend the very able treatise of Mr. Charles Ellet on the "Laws of Trade," and we now have the pleasure of presenting to our readers an exposition of some of these principles in a popular form. Mr. E. is of the opinion, that no effort should be spared in bringing this most important subject into general notice, and while in his former work, he has aimed at the foundation of the Laws of Trade, upon strict mathematical reasoning, for the satisfaction of the professional reader, he has in this one now before us, translated his mathematical, into popular phraseology, thus opening the subject to all classes of the community. There is no time more fitting than the present, for the discussion of this subject, and convinced as we are, of its momentous bearing, we recommend the paper of Mr. Ellet to the attentive perusal and earnest consideration of our readers.

**A POPULAR EXPOSITION OF THE INCORRECTNESS OF THE TARIFFS OF TOLL IN USE ON THE PUBLIC IMPROVEMENTS OF THE UNITED STATES.
BY CHARLES ELLET, JR., CIVIL ENGINEER.**

The object of this paper is to point out, in a brief and popular view, the consequences of some of the errors which are committed in the charges assessed on the public works of this country.

The writer has recently published a work* in which he has attempted to expose the true principles of trade, and to show the only correct mode of determining the tolls proper to be levied on our great lines of canals and railroads. But it has been suggested to him by some intelligent readers of that work, that the method of analysing the subject which he has been compelled to adopt in it, is not the best adapted to the pursuits of the class of readers most likely to be interested in the subject; and that some advantage might be derived from exhibiting, in a popular form, a few of the results which were there obtained by a different process. This paper is intended to subserve that purpose; and to show that the principles on which all the tariffs in the country are based, are unsound, and lead, in their application, to oppressive injustice to a portion of the community, and to great loss of trade and revenue to the improvements.

SECTION I.—Of the importance of the subject.

1. There are no questions of public policy which are thought to concern so intimately the general and particular interests of the people of this country, as those which relate to their internal improvements. The consideration of this subject constitutes the greatest part of the legislation of nearly all the States in the Union, and the employment of the privileges sanctioned by the law, constitutes a prominent portion of the efforts of individual enterprise. There are now completed and in use in the country more than three thousand miles of railroads, and not less than three thousand miles of canals, the construction of which has occasioned an actual expenditure of probably \$150,000,000, and for which loans have been incurred by the State governments or incorporated companies, to nearly an equal amount.

*An Essay on the Laws of Trade in reference to the works of Public Improvement in the United States.

This enormous investment of capital is by some viewed as alarming; and might indeed, appear so, when it is considered that a draft of some \$8,000,000 will be annually made on the country for the payment of the interest on this sum, and that the principal itself, in the brief space of twenty years, may possibly have to be refunded. On the other hand, there are sanguine advocates of improvements, who look to the revenue to be derived from the works themselves, consequent on the rapid growth and progressively increasing productiveness of the country, as offering an ample guarantee for the prompt payment of the interest, and the due liquidation of the principal, of the debt.

It is not the intention now to discuss this momentous question, or to endeavor to ascertain which of these hypotheses approaches nearest the truth. Both are but surmises, advanced as the result of a hasty glance at the facts, or possibly based on no safer evidence than the prepossessions, or mere conjectures, of the parties. They are wanting in that detail, that exhibition of statistical information, without which it is impossible to generalize with security.

Doubtless many of the works of the country will possess abundant means to sustain their credit; and among so many enterprises, it is equally probable that some have been undertaken which will fall very far short of the expectations of their patrons.

2. But, whatever may be the general ability of these immense lines of improvements, it is certain that the success and profitability of those which are now progressing under the fairest auspices, are not so well established but that it ought to be an object of deep solicitude with their proprietors to find the means of increasing their productiveness. To every state that has embarked in a career of internal improvement, and to every individual who has invested his property in such stock, it is an interesting question to ascertain the most efficient means of equalizing the charges on the trade, and increasing the revenue and tonnage of the line.

The public improvements of Pennsylvania are sinking that commonwealth in debt about a *million and a half per annum*—or, in other words, the interest on the loans incurred for their construction, added to the annual charges for repairs and superintendence, exceeds the gross revenue of the works from one or two millions of dollars per annum.

Those of Ohio, and many of those constructed by great incorporated joint stock companies, exhibit balances scarcely less unsatisfactory; and although these unpropitious results cannot be fairly adduced as evidences of the impolicy of the undertakings, they are facts which may be legitimately used in evidence of the necessity of inquiring into the correctness of the principles of their management. Many of them are now regarded as partial failures, and have involved the community in great pecuniary difficulty. Possibly a careful investigation of the principles on which their tariffs have been established, may lead to the conviction that there is some radical error of administration which may be advantageously corrected.

No more fitting season can be selected for such an investigation than the present. The system of public improvement is now prostrated throughout the country for want of the means necessary for the extension of the works. Those who have been engaged in their execution, may therefore take time to consider by what mode the tax with which they load their constructions may be lightened, or the revenue they pay may be augmented.

3. It is not less important that the charges adopted on the works should be those which would render them most productive to the stockholders, or to the commonwealth as a proprietor, than that they should be reconcilable

with principles of justice. In levying a tax for purposes of revenue on any portion of the property of the public, it has been an object of legislation in all times, to make the nearest possible approach to equity in its distribution. The tolls charged on the works of the commonwealth are intended for revenue, and they should be so adjusted, if such an adjustment be practicable, as to produce the greatest possible revenue with the least inequality in the taxation.

At the same time it is essential to have due regard to the cultivation of the trade, which is the primary object of the improvements—a condition which must be reconciled with those above stated—of drawing the greatest possible revenue from the transportation of the produce of the country, and an adherence to principles of equity in the distribution of the tax.

This may appear to be a complicated problem, the solution of which, however desirable in itself, can scarcely be regarded as attainable in practice.

I shall endeavor, however, to show by a few evident propositions, both that the principles by which these charges are now assessed on all our great lines, are such as operate unjustly upon a large portion of the country; are such as in a great measure defeat this primary object of the improvement, that of inviting the distant trade to a market—and such as reduce the revenue far below the limit belonging to a more just and more judicious tariff; and, at the same time, that an attention to the true laws of trade will render the avoidance of these errors exceedingly easy.

SECTION II.—Of the incorrectness of the principles on which tolls are at present assessed.

4. To be able to appreciate the necessity of a departure from the principles on which the present charges for the use of our public works are established, it is essential to examine into the effective operation of the scale now in use. To render the view which I design to take as little complicated as possible, it may be confined for the present to one of the principal divisions of the trade of the country. For, in treating of the laws of trade it is found convenient to divide the commerce of the line into two principal classes; in the first of which is included all those commodities which will bear but a limited charge for their transportation, and which, if taxed beyond that limit, will be excluded from the line and from market. This division usually consists of stone, coal, lumber, ore, lime, and many agricultural productions. Indeed it embraces all articles which will seek a market along the line in question, and no other; and in this respect is to be distinguished from that division of the trade which consists of more valuable commodities, and which, if not accommodated on one line, will find a passage by the route of a rival work.

Our present investigation will be confined to the first of these divisions.

5. The charges which are levied on this trade consist of what are usually termed *freight* and *toll*. If the work be a canal, by *freight* is understood the charge of the carrier, and by *toll* that of the state or corporation owning the work. In the management of railroads, it is usual for the company to act as carrier on their own line; and to make but one charge, which is called *toll*, for both objects. In this pamphlet I shall make a somewhat different application of these terms, and designate by *freight*, in either case, every expense actually incurred in the carriage of the commodity, and by *toll*, the clear profit on its transportation. So that if the carrier, or transporting company, charge seven mills per mile for the carriage of one ton of any article, and the cost of repairs and superintendence of the line due to the passage of that ton is three mills per mile, I call the *freight*

on the article one cent per ton per mile; and any charge, exceeding this three mills, which is assessed by the state or company, is what I denominate their *toll*.

6. In nearly every tariff of toll adopted in this country, the charge on every article is proportional to the distance it is transported on the line.—The *toll* is some fixed amount per ton per mile. This scale of taxation, I contend, is improper and unjust.

To examine the question, let us suppose the article to be lumber, of which the market value, at the point to which it is sent, is \$10 per ton. Let us also assume that the cost of producing this article, or preparing it for shipping on the canal, is \$6 per ton. It is then most obvious that if the charge for transportation on this commodity exceed \$4 per ton it will be wholly excluded from the line; for then the cost of carriage added to the cost of production would exceed the market value of the article, and there could be no profit to remunerate the producer. But if the charge be less than \$4 there will be a certain profit, and the article will be found to seek the market.

If now, this lumber is carried a space of *one hundred miles* to its mart, and the charge for *freight* is one cent per ton per mile, the freight for that distance will obviously be \$1, and there will remain a balance of \$3 for the extreme limit which the article will bear to be charged for toll. The toll levied by the state, at one cent per ton per mile, will be \$1, or one-third the amount, which the article could in this case sustain.

Let us next suppose that similar lumber comes upon the line at a distance of *three hundred miles* from the same mart. The charge for *freight* would now be \$3, and there would consequently be a residue of only \$1 on which the state might levy for toll. The commodity could bear no more than \$1—since that sum added to the \$3 freight would be \$4, or the difference between the cost of producing the lumber and its price in market. But, by the principle of taxation usually adopted, the toll assessed at one cent per ton per mile, would here be \$3, or three times as much as the article would bear. In other words, *at the distance of one hundred miles from the mart, in the usual tariffs, a commodity is charged one dollar where it might bear a charge of three, and at three hundred miles it is charged three dollars where it could bear but one.*

7. Does it need any argument to prove that a scale producing such results is neither compatible with principles of equity or good economy? Is it not manifestly unjust to charge the man who is situated three hundred miles from market three times as much as he can afford to pay, while the man at one hundred miles can afford to pay three times as much as he is charged? Is it not any thing but good economy to tax all the trade in this article beyond two hundred miles so heavily that it is totally driven from the line, when, if the tolls were differently assessed, it might be invited, and made to pay a respectable revenue to the state? And is not the primary object of the work defeated by the adoption of a tariff that excludes those commodities from it which it was especially intended to draw to market—an effect which is accompanied by a direct sacrifice of trade, revenue and even justice?

8. I think it can scarcely need more than this plain exposition to make clear to any reflecting mind that some of the charges on the public works of this country need revision: that they are based on principles which are unsound, and at once do injury to the proprietors of the work, and injustice to a large portion of the public. The commonwealth, as the constructor and owner of the improvement, is a sufferer in the loss of the trade that is excluded, and the revenue that might be derived from it; the citizens of

the emporium which is the mart of the line, suffer from the contraction of their business in consequence of the exclusion of the articles in which they traffic; and the country traversed by the improvement, and taxed, perhaps, for its construction, suffers from its inability to share the benefits which the work was designed to confer.

SECTION III.—Further evidence of the loss of trade consequent on uniform charges.

9. To render more palpable the fact that a charge for toll proportioned directly to the distance will cause the exclusion of a certain amount of tonnage, without conferring any compensating advantage, we will consider the subject with the aid of a diagram.

Fig. 1.

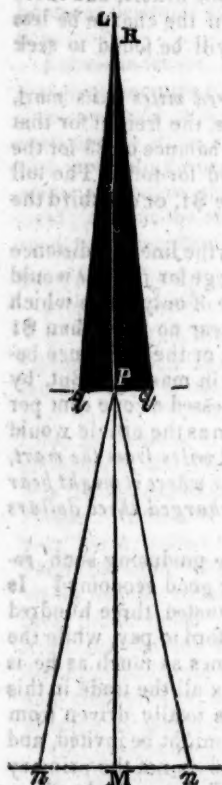


Fig. 2.



Let M in the figure be the position of the mart, and M L the line of the improvement: and let us assume, as before, that the commodity will be capable of sustaining a charge of \$4 per ton for its transportation; that the toll is one cent per ton per mile, the freight likewise one cent, and the cost of carriage on the lateral roads by which the tonnage is brought to the work, is ten cents per ton per mile.

The distance Mn from which this commodity can be brought to the mart at M on the lateral roads nM, nM, will then be 40 miles; and the distance MP which we can afford to carry it along the improvement, at an aggregate charge of two cents per ton per mile, will of course be two hundred miles. The area of country, therefore, which will supply trade to the line, will be represented by the triangle nPn, having a base nn of 80 miles, and a height MP of two hundred miles.

10. Now, it is apparent that the line will receive no tonnage of this article, from beyond the point P; and therefore, that if the trade were permitted to come free of toll from beyond that point, there would result a certain increase of tonnage, which would be accompanied by no diminution of revenue.

Under such an arrangement of the tariff, the charge for freight from P to M, for produce coming from the country beyond P, would be only \$2, and there would consequently be left a balance at P of \$2 out of the limit of \$4 which the article could sustain, to bear the cost of its carriage along the lateral roads to the improvement, and down the improvement to the mart.

This balance will be sufficient to pay the cost of transportation on the lateral road from q to P , a distance of twenty miles, at ten cents per ton per mile; and the charge for freight along the improvement, from R to P , a distance of two hundred miles, at one cent per ton per mile. It would, therefore, be within the ability of the state or company, in this example, to extend the benefits of the improvement four hundred miles into the interior, instead of two hundred, and increase the tonnage of the line, with all the incidental advantages, 50 per cent., without sustaining any loss of revenue.

11. It is far from my intention here to advocate a tariff arranged with a view to this effect; but merely to show what is lost by those which are commonly adopted. Instead of draining only the country contained in the triangle nPn , which will supply the trade where the charge for toll is one cent, and freight one cent, by charging toll from M to P , and permitting all articles brought from beyond the angle P to pass free of toll, the shaded triangle qRq in the figure, will be added to the area using the work and supplying its tonnage. The value of the improvement to the country will be increased one half; the trade of the city at M will likewise be increased one half, and the value of the property of the commonwealth, as far as it is dependent on the activity of the work, will be proportionally augmented.

But such an arrangement would effect injustice, and could not therefore receive the sanction of a government administered in a due regard to the first principles of its existence—the equal protection of the citizens, and an equitable distribution of the benefits which its constitution was intended to confer.

Such a tariff would augment the tonnage of the line—but it would produce that result by taxing the citizen immediately at P \$4, and excluding him from the work; and the neighbor immediately beyond P but \$2, and inviting him at the expense of a premium.

Besides these objections to this arrangement, there exists the additional and important one, that it would not fulfil another imperative condition—that of obtaining the greatest revenue from the trade.

(To be continued.)

RAILROADS.

The following letter from Judge Wright, who was the Chief Engineer of the Erie Canal, and who is now in the service of the State of Virginia, to Col. Dexter, the Engineer of the Selma and Tennessee Railroad, treats of matters of the deepest interest to the State of Tennessee. It will be seen that Judge Wright is of opinion that a line of railroad from the Atlantic cities on the Eastern slope of the Alleghanies, in a South Westerly direction through the Virginia Valley and the Valley of the Tennessee to Gunter's landing, could never have a competing route, for all travel from the Atlantic cities to the cities of Mobile and New Orleans.

JUDGE WRIGHT'S LETTER.

Scott's Ferry, Albemarle Co. Va. }
December 2d, 1839. *}*

My Dear Sir:—I received your favor of the 20th ult. together with the Reports of the Selma and Tennessee Railroad Company. I have examined them carefully, and looked at the map of the United States, to see the full bearing of your great project. I confess to you that when I look at the importance of a line of Railroad from the Atlantic cities, on the eastern slope of the Alleghanies, in a southwesterly direction, through the Virginia Valley, and at the favorable character of the country, as elicited by the various surveys which have been made from Lynchburg and Buchanan, on James River, to the Tennessee line, near the Boat Yard, showing that a route can be had without stationary power, and with grades not exceeding fifty or

sixty feet to the mile, (and presuming, that by following the Valley of the Tennessee, favorable grades may be had to Gunter's Landing,) I think I see a location for a Railroad which can never have a competing route, for all travel from the Atlantic cities to the cities of Mobile and New Orleans.

The two last years have satisfied most people that the Ohio cannot be relied upon for four or five month, and leaves too much uncertainty to induce travellers that way.

The fact which you mentioned in your report of the Legislature of Pennsylvania, having taken action on the plan of getting to the Mississippi, by a railroad through three States, rather than rely upon the Ohio River, is strong evidence of the importance of something being done to remedy the evils in business, occasioned by severe droughts in the Western Rivers.

Our rivers on the Eastern slope are not subject to the same fluctuations of those west of the mountains, and the canal I am now forming along James River, will never want water. The town of Buchanan, (Virginia Valley) is 200 miles above Richmond. To this point the canal will soon be done; it being now under contract to within 20 miles of that place. From Buchanan there will soon be a Railroad, which uniting at a point 30 miles distant, with a railroad from Lynchburg, will pass on South to the Tennessee line, a distance of 150 miles.

The State of Tennessee has always been ready to meet Virginia, and carry it down by Knoxville, and so on to the line of Alabama.

If, therefore, the State of Alabama brings up her line to the Tennessee river, at Gunter's landing, it is certain that the States of Tennessee and Virginia will not be backward in carrying it on through, to connect with the lines now done, and in great progress towards completion. This must and will be the case, and when once done, a look at the map of the United States, will satisfy any one that no route can be projected which can compete with this, in directness of course and easy grades, taken as a whole.

I have examined your estimates of cost of grading and bridging. If you are correct in these, it shows a remarkably feasible route, and one not equalled in any country I have ever examined.

You appear to have some difficulties on the first section, from Tennessee river, and think an inclined plane, with stationary power, may be required. I had rather have grades of 90 feet per mile, than stationary power;—and should prefer to increase the distance, rather than have a change of power, in any way, either by horses or steam.

I wish you success in your application to Congress. I shall be very glad to see you when you come North, and to renew and brighten the chain of friendship, which has so long existed. Although now an old man, hard upon 70, still I am wandering about doing all the good I can, and shall continue to do so, while a kind and merciful Providence blesses me with health and the use of my faculties.

In a few weeks we shall have an annual report of the James river and Kanawha company, and I will send you a copy.

With much esteem, I am, dear Sir,

Very truly yours. BENJ. WRIGHT, *Civil Engineer.*

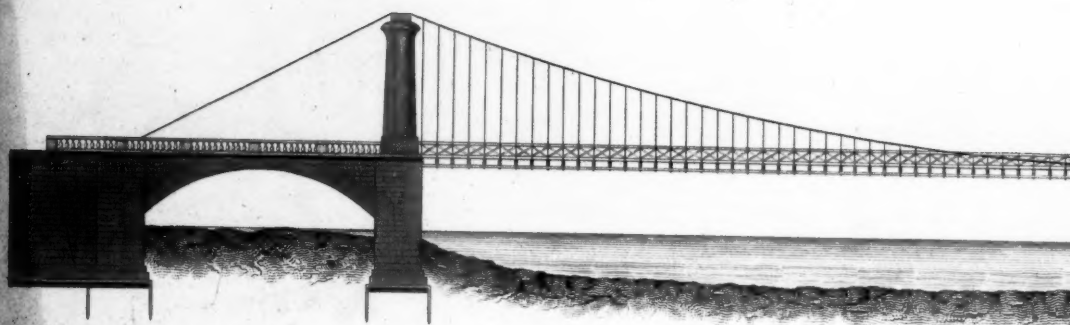
A. A. DEXTER, Esq., *Civil Engineer.*

✍ On examining the article in our last number, on Dr. Lardner's experiments, it appears that the writer has fallen into an error, which vitiates much of his reasoning. The article was prepared in haste, and the writer is not at present in the city, but will doubtless make the necessary correction. For the present, we request a suspension of any criticism upon it.



Elevation of the Wire S.

25



of the Wire Suspension Bridge across the Schuylkill at Philadelphia

By Charles Ellet Jr. Civil Engineer

